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On the FISH *encloſed in* STONE *of* MONTE BOLCA.

By the Rev. GEORGE GRAYDON, *LL.B. M.R.I.A.* *and Secretary of foreign Correſpondence.*

Read March 1, 1794.

IT is impoſſible for thoſe who have not ſeen and examined the foſſil fiſh of Monte Bolca to form an adequate idea of that moſt curious phenomenon of natural hiſtory: In this, as in every thing elſe where the ſenſible qualities of bodies are concerned, it is well known that deſcription, however exact, muſt come far ſhort of conveying the impreſſions that are given immediately by the ſenſes *. That ſuch is remarkably the caſe in the preſent inſtance, I can teſtify from experience; for

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* For this reaſon, and to ſupply the defects of my pen, I have, with the permiſſion of the Academy, placed a few ſmall ſpecimens of theſe fiſh in their muſeum. To them I beg to refer ſuch members as wiſh for more accurate ideas than it is poſſible for words alone to convey. An engraving of ſome of theſe is annexed to this paper.

for though I was not unacquainted with theſe ſingular productions by deſcription, I was not leſs forcibly ſtruck, on firſt ſeeing a collection of them at Verona in January 1791, than if I had never heard of them before. As I had not, at that time, leiſure to pay much attention to them, or to make the minute inquiries which they ſeemed ſo well to deſerve, I determined, if I ſhould again paſs through this part of Italy at a favourable ſeaſon for the purpoſe, to viſit, if poſſible, the place where they were found, as well to verify the fact, as, from an examination of the ſituation and other particularities of the ſpot, to endeavour to form ſome conjecture as to the origin of a circumſtance ſo extraordinary.

THIS opportunity occurring in the month of June following, I took up my reſidence for ſome days at the town of Arzignan in the Vicentine, by the recommendation of the well-known Abate Alberto Fortis *, and from thence occaſionally made excurſions through the neighbouring hills, under the guidance of

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* I was much indebted to the hoſpitality and kind attention of the Abate Fortis to my accommodation in every reſpect, during the ſhort time that I had it in my power to ſpend in examining the Euganean hills, and other curious diſtricts of the Venetian territory. It is much to be regretted that the many intereſting papers which this gentleman has given to the world, at different times and in various ſhapes, on particular parts of the north of Italy, have never been collected into one publication. Many valuable works of Signior Giov. Arduino of Venice have alſo appeared in the ſame ſcattered manner, which, though written ſome years back, would form a moſt uſeful collection of accurate local deſcriptions and obſervations. At preſent it is very troubleſome and difficult to procure many of the writings of theſe authors, even in the countries where they were publiſhed

of peaſants well acquainted with the country. In one of theſe I had the pleaſure of ſeeing the quarries of foſſil fiſh at Monte Bolca. Of theſe, and ſuch circumſtances relating to them as the very ſhort time I could ſpend there enabled me to collect, I ſhall proceed to give the Academy the beſt account in my power; relating, firſt, the facts as I found them; and then the inferences which they ſuggeſted to my mind as to the poſſible immediate cauſes of this ſtriking phenomenon.

MONTE BOLCA lies on the border of the Veroneſe territory, about fifty miles W. N. W. of the Lagunes of Venice, which, I believe, is the neareſt ſea. I am not informed of its height, but it muſt be pretty conſiderable, as I underſtood from the inhabitants that the climate is too cold for the growth of the country fruits which are common about every peaſant's houſe in the lower grounds, ſuch as apricots, apples, cherries, &c. as well as vines. It forms one of the chain or ladder of ſecondary hills, which, from ſome diſtance within the adjoining Vicentine, riſe gradually above one another to the Alps of the Biſhopric of Trent.

GREAT part of this tract of country has been conſidered by many Italian, as well as other naturaliſts of eminence that have viſited it, as covered with productions of extinct volcanoes. The ſuppoſed lava of theſe diſtricts differs eſſentially from that of which the Euganean hills are compoſed; this latter is of a whitiſh, yellowiſh or browniſh grey, rough and coarſe in the grain, and mixed with numerous minute fragments of what they denominate ſchorl and felt-ſpar; whence Sir John Strange, Monſieur de Dolomieu, and others, have called it granitical, though unlike granite in many important points: But the ſuppoſed compact lava of the Vicentine and Veroneſe is black, or dark blue, of a cloſe and rather fine grain, even, and almoſt homogeneous, except that it ſometimes contains a few fragments of ſchorl, and is wholly of the argillaceous genus, and of the trapp or homblend ſpecies; and in ſhort almoſt perfectly reſembles our baſaltic ſtone of the county of Antrim, and the N. W. of Scotland. The baſaltic columns of San Giovanni Ilarione, deſcribed by Sir John Strange, lie not many miles from Bolca, on the ſide of a valley that leads to it, and the ſummit of this hill itſelf was, many years ago, diſcovered by Abate Fortis to be crowned with a great maſs of tolerably defined columnar baſalte.

THE whole of the hill, as far as I could obſerve, ſeems to be compoſed of ſimilar, or at leaſt of argillaceous matter, except the quarries in which the fiſh are found, which are calcareous, and lie at about half a mile from the ſummit. Beſides the diſſimilarity of theſe to the other materials of the hill, it is further important to remark that they do not form a continued ſtratum, but lie in great and wholly detached and diſtinct maſſes, as it were accidentally imbedded in the ſide of the hill, ſet in a looſe rubble of argillaceous, and the ſame kind of calcareous fragments, the whole more or leſs in a ſtate of decompoſition.

THE maſs that has been moſt worked ſtands near the point of an angle formed by two deep channels that have been worn by a greater and leſs torrent that meet there. The height of its face above the preſent ſurface is, as well as I can recollect, about fourteen or fifteen feet; but as it cannot be determined to what depth it may be buried in the ground, it is not eaſy to judge what its poſitive heighth or breadth may be. The length of the face, I ſhould ſuppoſe, for I did not meaſure it, may be two hundred feet or upwards. The ſtone is of a ſchiſtous or flag-like ſtructure, the leaves lying in the ſame direction, and parallel to each other; but this direction, it is to be remarked, is neither horizontal, nor coincident with the ſlope of the hill.

I GOT ſome of the people that are uſually employed in working the quarry to bring their tools, and ſhew me their manner of operation, as well to be informed in this, as, if poſſible, to ſee ſome fiſh actually opened in the ſtone. Unfortunately the day proved very wet, which prevented my having more than two or three workmen, but from theſe I procured almoſt all the information and ſatisfaction I could expect. I ſpent nearly three hours on the ſpot, during which time I not only ſaw ſome fiſh, as well as a few remains of marine vegetables found by the men, but had the pleaſure to find ſome myſelf, opening with my own hands ſtones which contained them. Theſe I collected, packed and brought home; and ſome of them are now in the muſeum of the Academy: They are but ſmall indeed, and in the mutilated ſtate that accident preſented them; but, I believe, they are amply ſufficient to authenticate the principal fact, if any one ſhould be found to doubt it.

The manner of working theſe ſtones is by detaching from the face of the quarry moderate ſized blocks, which are then drawn out, ſet an edge, and quickly ſplit with ſharp-ſided hammers or wedges, the workmen glancing between the leaves, to obſerve if there be any mark of fiſh, or other organic ſubſtance; when they diſcover ſuch, if they happen to be ſhattered, as they generally are, by the rude manner of opening, and the fragile texture of the ſtone, they ſet about to collect all the fragments that compoſe the piece as carefully as poſſible, detaching alſo from the great ſtone ſuch parts as may remain adhering to it. When their day's work is finiſhed, they bring their collections to their houſes, until they happen to go, either to market, or on any other occaſion, to Verona, when they take them in baſkets, juſt as they are, to the proprietor of the ſoil, who is their landlord and employer; or frequently, I believe, to ſell underhand, for their own profit, to ſome naturaliſt there, or to ſome of the ſhops that vend theſe productions. Thoſe who receive them in this manner from the peaſants are then obliged to employ a ſkilful ſtone-cutter, to find and arrange together the ſeveral fragments that compoſe each piece, and fineer or cement them on another ſtone of the ſame kind, which is ſometimes done with ſuch art and exactneſs that it is not eaſy to diſcern where they have been joined; and thus the ſpecimens are made up for cabinets or for ſale.

Besides this principal quarry or maſs, from which almoſt all the fiſh yet found have been extracted, the workmen ſhew two or three others of the ſame ſtone ſeated in the ſides of the adjoining banks, ſome of which, they ſaid, had been diſcovered not long ſince: They had all been tried, and were found preciſely of the ſame kind, and equally containing fiſh; but the people being very poor, and no funds allowed for the buſineſs, which would require conſiderable expenſe to clear away the bearing, and prepare for working to advantage, nothing of conſequence had been done.

The ſoil of theſe quarries had been the property of a Signor Bozza, formerly an apothecary of Verona, who purchaſed, or took it on leaſe, many years ago, and whoſe cabinet is too well known to all the naturaliſts of Europe, and has been too long one of the principal objects of the attention and admiration of thoſe who paſs through this town, to make it neceſſary for me to enter into any detailed deſcription of it; but while I was there his whole collection, with the quarries, was agreed for, and, as I was informed, purchaſed, at a very conſiderable expenſe, by the Marquis Gazola, of that city. This gentleman had already a very fine collection of his own, containing many fiſh that were not in Bozza's. He was ſo kind as to give me a catalogue of theſe, in addition to Bozza's printed catalogue, both of which, as I have not ſeen them in any publication, I ſhall ſubjoin to this paper*. They will be found to contain together the ſcientific names of upwards of one hundred different ſpecies of fiſh, with diſtinct references to the authors by whom they have been deſcribed, and the plates in which they are repreſented; ſo that thoſe who will take the pains may, by actual compariſon, judge of the reſemblance and propriety of denomination. But what is moſt remarkable is, that theſe fiſh are deſcribed, by the authors referred to, as the modern natives of various ſeas, moſt remote from each other; and not of Europe only, but of Aſia, the Indian Ocean, the South Sea, Africa, North and South America; and in addition to theſe ſome few of ſweet water*.

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* I give theſe catalogues juſt as I received them from Mr. Bozza and the Marquis Gazola, poſſeſſing neither ſufficient knowledge of the natural hiſtory of fiſhes

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fiſhes to enable me to judge whether the cabinet ſpecimens have been faithfully denominated or not, nor having had time or leiſure enough at Verona, though I had underſtood the ſubject, to go through ſuch an examination. I will not even venture to anſwer whether ſome tricks may not have been played by the ſtone-cutters who arrange theſe ſpecimens:—Whether, for inſtance, they may not, in ſome caſes, have contrived to ſuit pieces of different fiſh to each other in ſuch a manner as to form a whole that might correſpond with the plates in books of natural hiſtory. Such an idea has been ſuggeſted, perhaps founded on the well-known dexterity of Italian workmen in ſimilar fabrications; but in the preſent inſtance, though I will not ſay it is abſolutely impoſſible, I really think it ſo very improbable as to deſerve little ſerious attention.

* Mr. Bozza, in a paper publiſhed by him a few years ago, ſpeaks of his collection as follows: " In my cabinet, which contains upwards of ſix hundred fiſh " of different ſizes, all extracted from Bolca, there are more than one hundred " whoſe kinds are known, which differ from each other in genus and ſpecies, and " *many others beſides to which ſimilar living ones have not yet been diſcovered.*" In another paſſage he adds, " The firſt decade of fiſh publiſhed by M. Brouſſonet has " aſcertained to us that many of thoſe found at Bolca are natives of the South " Sea—of theſe I have four, which agree exactly in form, in proportions and in

" fins

THAT all theſe ſhould be found, as is aſſerted, perfectly and unequivocally defined within the narrow compaſs of the quarry of Monte Bolca, muſt ſurely be conſidered a very aſtoniſhing circumſtance, and ſuch as I believe can ſcarcely be paralled in what has hitherto been diſcovered of the natural hiſtory of our globe.

IT has been already obſerved, that the ſtone in which theſe fiſh are found is calcareous, and of a ſchiſtous ſtructure, capable of being ſplit into flags or laminæ of various thickneſs and dimenſions. Moſt mineralogiſts who have mentioned it call it a marle or marley ſchiſt. Its colour is whitiſh, yellowiſh or bluiſh grey; the grain, though not coarſe, is very dull and earthy; it varies a good deal in hardneſs, but in general eaſily yields to the knife, though not to the nail. Every part of the maſs, whether immediately ſurrounding fiſh or not, on being ſtruck or ſcraped hard, emits a peculiar kind of fetid ſmell which cannot eaſily be defined. It is ſomewhat of the kind, yet differs conſiderably from the ſmell of the lapis ſuillus or ſwine-ſtone. It is not properly hepatic, unleſs perhaps it might be called animal-hepatic *.

" fins with four deſcribed by M. Brouſſonet, which are peculiar to the ſea of " Otaheite, which are the *Polynemus plebeius*, or Emoi of the Otaheitans; the Go-" bius ſtrigatus, which they call Jaipoa; the Chætodon trioſtegus, and the Gobius " oſcellaris:"—Theſe perfectly correſpond with the fiſh given by Sir Joſeph Banks to M. Brouſſonet.

* Abate Fortis obſerves the ſame thing of the calcareous ſtone, containing many ſhells of the valley of Ronca in the Veroneſe, at no great diſtance from Bolca. " Every

The fiſh are of a dark-brown colour, and therefore appear very diſtinctly on the light ground of the ſtone; they lie flat between the laminæ; their profile, and their ſeveral parts, little, if at all, diſtorted from their natural ſhape and dimenſions, except that in ſome caſes the ſtone incloſing them ſeems to have ſuffered ſome little diſturbance, as if by ſettlement, after their incloſure, by which they are found, at times, ſomewhat fractured, and the parts a little disjoined. Their whole form is well defined, but the harder parts, ſuch as the head, fins, ſpine, with the bones that branch from it on either ſide, and indeed all the bones in general, as well as in ſome the ſcales, are remarkably well expreſſed. The dark-brown matter compoſing theſe fiſh remains diſtinct, and may be picked off from the ſtone, and projects in proportion to the thickneſs of each part in its natural ſtate. It is hard, brittle, and rather gloſſy through its ſubſtance, except in ſome of the groſſer bones, ſuch as the joints of the vertebræ, which, though of this appearance externally, are found, when broken, to conſiſt internally of laminar cryſtallized calcareous ſpar.

To thoſe who may not have an opportunity of ſeeing ſpecimens of theſe fiſh, it is further proper to mention, that when the leaves of ſtone that encloſe them are opened, the forms are

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" *Every ſtroke of the hammer or other ſolid body,*" ſays he " diſengages from this " ſtone a moſt fetid cadaverous odour, by no means bituminous, but a true ſmell " reſulting from decayed animal putrefactive matter. *Di vero fracidume animale.*" Fortis Della Valle Vulcanico-Marina di Ronca, p. 24.

are found equally announced on each of the oppoſite ſides, with this difference however, that more or leſs of the prominent brown matter of the bones, fins, and other parts, ſometimes adheres to one leaf and ſometimes to another, or frequently is divided between both; the prominences on one ſide, when the pieces have been carefully and well put together, being exactly anſwered by correſponding hollows on the other; and thus the more valuable ſpecimens are formed in duplicates. This, properly conſidered, muſt ſurely make the difficulty of fabrication, in ſuch inſtances at leaſt, ſo great, that it may well be deemed inſurmountable; and if not from the nature of the caſe itſelf, yet decidedly ſo at ſuch an expenſe, as either the capital of the late proprietor, or the prices at which I underſtood he ſometimes parted with ſpecimens, would bear; ſome in his, as well as in Marquis Gazola's own cabinet, were of an immenſe ſize; certainly, as the catalogue mentions, fully three feet long.

I HAVE now related all the facts worthy of notice which I recollect to have fallen within my obſervation relative to theſe curious foſſils; and I truſt I have done ſo faithfully and without a view to any particular theory or ſyſtem of explanation: In fact, I viſited the ſpot where they are found wholly unprejudiced as to the manner of accounting for the phænomenon, and indeed wholly uninformed, as I ſtill am, of any attempt to account for it, except on vague and general principles *. What

I ſhall

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* Whether the following attempt to aſſign immediate cauſes for the production of the phænomena now deſcribed can lay claim even to novelty, as a recommendation

I ſhall now venture to lay before the Academy on this ſubject, I can therefore ſay with confidence, is purely the reſult of inferences ſuggeſted to my mind by the appearances of the objects themſelves, and their ſeveral concomitant circumſtances.

I SUPPOSE no one that has attended to the deſcription of theſe foſſils, and ſtill leſs that has examined the ſpecimens themſelves, will doubt that the forms which they exhibit are the remains of once actually exiſting fiſh.

BUT theſe, it ſhould be well remarked, differ eſſentially from the forms of fiſh that are frequently found in argillaceous ſchiſtus, as well as from what are commonly called petrifactions of ſhells, &c. which abound in moſt lime-ſtone ſtrata. In this latter caſe we have ſeldom more than the mere external ſhapes preſerved; the ſubſtance is wholly changed, and what remains reſembles,

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tion to the attention of the Academy, I cannot poſitively aſſert, my information in theſe ſubjects being very limited; I can only ſay, that nothing of the kind has fallen within my obſervation. I have conſulted ſome modern Italian writers of mineralogy and natural hiſtory, but find them very conciſe in what they ſay of theſe fiſh. P. Petrini, the very worthy mineralogical profeſſor of the Collegio Nazzareno at Rome, has an appendix to the 2d vol. of his Gabinetto Mineralogico del Collegio Nazzareno, publiſhed at Rome in 1792, which treats expreſsly of petrified remains of animal and vegetable ſubſtances, but contains nothing relative to theſe. Signior Bozza, in his paper above quoted, which is entitled, Della Rivoluzione ſofferta dal Globo Terraqueo, ſpeaks only of remote and general cauſes: And the Marquis Gazola, to whom I mentioned at Verona the outlines of the explanation here attempted, immediately after my viſit to Bolca, ſeemed wholly unacquainted with any thing ſimilar. Theſe circumſtances, particularly the laſt, led me to preſume that the ideas here given had not been anticipated, and emboldened me, on that ground, to ſubmit them to the Academy.

reſembles, in general, a portion of the ſame matter of which the maſs conſiſts, caſt, as it were, into a mould formed by the outſide impreſſion of the ſhell*. In ſome caſes the ſhell-formed nucleus differs from the ſurrounding matter, by being of a brighter colour, and of a ſparry texture; but, in almoſt all, the original ſhell that gave the impreſſion exiſts no longer as ſuch, nor any certain remains of it. The ſame holds equally in the former caſe, a bare impreſſion of fiſh only remaining, and ſeldom any thing that can be thought to reſemble any part of the ſubſtance that gave it†; whereas in theſe of Monte Bolca, not only the forms are preſerved uncommonly perfect, but even every reſidue of animal matter that could be expected to reſiſt the natural deſtructive cauſes, and the immenſe lapſe of time in any, the moſt favourable circumſtances, is found ſtill exiſting. The prominent brown matter with which all the harder and leſs corruptible parts of the animal are ſo ſtrongly marked in the ſtone, and which may be detached from it with the point of a knife, inſpection alone will determine to be of a nature wholly different from the incloſing ſubſtance, and as far as can be preſumed without analyſis, to be the actual dry remains of the animal bodies, in ſuch a ſtate as almoſt to authorize their being called fiſh-mummies ‡.

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* It is to be obſerved that I ſpeak here only of the petrified ſhells that are found imbedded in ſolid lime-ſtone ſtrata, and forming part of the ſtone; yet even theſe ſhells and their fragments ſometimes, though rarely, retain their natural ſubſtance and appearances, as in the beautiful Lumachella di Carinthia; but in leſs compact beds, ſuch as ſand, marle, clay, &c. ſhells are often found little changed from their original ſtate.

† Impreſſions of fiſh, partly in argillaceous and partly in calcareous ſchiſtus, have been found in a variety of places: In Syria, between Batron and Diebail; in the mountains of Caſtravan, near Baruth; in Antigua, nine hundred feet above the level of the ſea; at Monte Viale in the Vicentine; at Scapezzano in the Campagna of Rome; in the valley of Glaris; at Mont Pilate, in the canton of Lucern; near Angers; and at Eichſtedt in Franconia. Theſe are moſtly ſea fiſh. River fiſh are found in the copper flats of Eiſleben, in the county of Mansfeld, near Pappenheim in the Pallatinate, and at Œningen in Suabia.—See P. Pinis Mem. ſulle rivolugions del Globo terreſtre, in the 5th vol. of the Societa Italiana of Verona, p. 238. Mr. Raſpe informs me that a Baron Francis Beroldingen has given, ſome years ago, a very circumſtantial and ſatisfactory account of the fiſh found at Œningen; but I have not ſeen his work. He alſo tells me he ſaw, many years ago, a ſpecimen equal to any of the Bolca fiſh in the poſſeſſion of the late Profeſſor Green at Cambridge, found in ſome part of Leiceſterſhire, but he could not learn the exact place.—He adds that he has lately found numberleſs impreſſions of fiſh in

But when we recollect of what very ſoft and corruptible materials the bodies of fiſhes are compoſed, not conſiſting of the firm

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in bituminous ſchiſtus, in Caithneſs on the river Thurſo near Carſgo; and on the ſlope of Gerſton-hill. To theſe I will add a fiſh engraved and ſhortly mentioned by Doctor Naſh, in his Hiſtory of Worceſterſhire, p. 236, and found in a ſtone-pit of the pariſh of Cleve or Clive in that county, for the communication of which I am indebted to the Biſhop of Dromore. With regard to moſt of theſe the ingenious M. Volta, in his Elements of Mineralogy, publiſhed in 8vo. at Cremona, 1787, p. 292, obſerves, after ſhortly mentioning the fiſh of Mount Bolca, that in Germany and elſewhere ſlate and calcareous ſtones are found containing the impreſſions of the bones or ſkeletons of various ſpecies of fiſh, the reſt of the animal being deſtroyed; and theſe impreſſions he denominates Typolites, to diſtinguiſh them from thoſe which he calls peculiarly Icthyolites, which term he confines to ſuch ſpecimens as exhibit the animal itſelf either dried or petrified; and of theſe laſt the only inſtance that he gives is the fiſh of Bolca.

‡ M. Volta calls the manner in which theſe fiſh are preſerved a Natural Embalming.—Elem. Min. p.

firm muſcles and tendons that inveſt the bones of land animals; when we call to mind in how very ſhort a time ſuch of them as die, or remain dead in their own element, do actually corrupt, and run into ſuch complete diſſolution as to obliterate the whole form, the bones only remaining, a fragile and imperfect indication of the ſpecies to which they had belonged;—and further, when we find, in the caſes juſt now mentioned, that ſubſtances ſo hard and durable as ſhells have not been able to withſtand the corroding influence of time, muſt it not aſtoniſh us to find, that in this inſtance, nature has been able to effect more than perhaps the moſt ſtudied art could have accompliſhed, and will it not force us to have recourſe to more than ordinary cauſes to account for a phænomenon ſo extraordinary?

The very perfect preſervation of the living form which we ſee in theſe ſpecimens, I conſider as a certain proof that the animals could not have been long dead before they were encloſed in the matter that ſurrounds them; from the ſame circumſtance it follows equally, that this matter muſt have been in a very fine and pulverulent ſtate, ſuſpended in, or ſubſiding from the water in which the fiſh ſwam not long before. Here then we have next to a demonſtration, of two inferences of moſt important and fundamental facts, which are of material conſequence to our preſent enquiry: Firſt, that theſe animals were alive, and of courſe that the water in which they were was clear and fit for the ſupport of their life, at a very ſhort period before they were enveloped in the matter of their preſent ſtony encloſure; and ſecondly, that this matter muſt have been very ſuddenly diffuſed through that water in a pulverulent ſtate, from whence ſpeedily ſubſiding, it caught and encloſed the fiſh now dead, and probably deriving their death from this very cauſe.

These inferences being admitted to follow, from the preſervation of the exact form as we ſee it in theſe fiſh, we may advance a ſtep farther, and obſerve, that as not only the form is preſerved, but a remarkable proportion of the very animal ſubſtance, to account for this effect we ſhall find it neceſſary to ſuppoſe, that the encloſing matter muſt have been of ſuch a nature, or in ſuch a ſtate, as to fit it for the ſpeedy abſorption of the ſofter and more pulpy parts of theſe fiſh, as faſt as they became abſorbable.

To ſee the neceſſity of this concluſion, let us in the firſt place recollect that the whole operation muſt, from the nature of the caſe, be conceived to have taken place in or under water; either then we muſt ſuppoſe that the dead fiſh continued floating at large, until the proceſs of putrefaction had taken place, in which caſe, indeed, the conveyance of the corrupting animal matter is eaſily accounted for; but, with it, the forms, not to ſay thoſe parts of their ſubſtance that are ſeen to remain, would be wholly loſt; or elſe we muſt imagine them arreſted, before putrefaction, in the depoſition of their preſent ſtony bed, by which all acceſs to the water as the vehicle of the ſoft putrefying parts is cut off, and we muſt look for ſome other mode of accounting for the ſpeedy removal of theſe parts; but ſuch removal, by ſome means or other, is abſolutely neceſſary to be ſuppoſed; for ſhould this tender animal matter reſt any time unremoved, it would not only ſoon infect and involve all, but the moſt ſolid bones perhaps, in one complete corruption and diſſolution, and conſequently leave no other veſtige of the animals remaining; but, by the diſengagement of putrid air, or of the different ſpecies of gaſes produced by the putrefactive fermentation, either the ſurrounding matter muſt be puffed into cavities and air-bladders; or, if the medium was ſufficiently yielding to admit theſe gaſes to collect and force a paſſage upwards, ſuch an inteſtine motion muſt be produced, as would have greatly diſturbed, if not deſtroyed, not only the regular laminar ſtructure of the ſtone, but the very forms and ſubſtance of the fiſh as we ſee them, contrary to experience, and the actual ſtate of the facts.

FROM theſe conſiderations therefore it ſeems juſt to conclude that the bodies of theſe animals did not undergo any ſimultaneous putrefaction; but as it is clear that their oily, mucilaginous, and other ſoft parts muſt have been conveyed away, to have produced this effect, without general putrefaction, in the circumſtances here ſtated, I conceive can only be explained on the ſuppoſition of a rapid abſorption of theſe by the incloſing matter, as faſt as they become capable of it.

WE are now to look for a cauſe adequate to the production of the ſeveral effects, which, from the above ſtatement, appear to have taken place,—a cauſe which ſhall account for the ſudden, and, as I may call it, unexpected diffuſion in a part of the ſea, of the kind of ſtony matter that we find incloſing theſe fiſh, in a pulverulent form, and in the immenſe quantity indicated by the bulk of the maſs; for their immediate loſs of life and ſpeedy incloſure in a bed of this matter—and for ſuch a ſtate of it as ſhould render it capable and fit, though immerſed in water, for the abſorption of the ſofter animal parts before fermentation could ariſe, as well as for leaving the harder and leſs abſorbable portions of their ſubſtance undeſtroyed, and in ſuch a ſtate as to reſiſt the no leſs deſtructive influence of ſucceeding time.

And here we are naturally led, by the quality and circumſtances of the incloſing ſtone, to a ſimple cauſe, which, though it might be too much to aſſert to be demonſtratively the real one, yet I believe will be allowed fully equal to the effects, and perhaps I might venture to ſay, almoſt excluſively ſo. This ſtone, it has already been obſerved, is wholly calcareous, of a light colour, of a grain dull though fine, and wholly devoid of any cryſtalline or ſparry appearance. Now it is well known that lime-ſtone, whatever its original colour may have been, becomes uniformly white or whitiſh, on being calcined or burnt more or leſs to a lime; that after this calcination it immediately ſlacks or falls into a powder, on being immerſed in water; and by agitation is eaſily diffuſed in this element, from which, if left in tranquillity, it ſoon ſubſides in a pulverulent ſtate; that this diffuſion of lime in water quickly deprives of life ſuch fiſh as happen to lie within its reach; and, in fine, there is every reaſon to believe, that a depoſition of this nature poſſeſſes remarkably the quality, juſt deſcribed, of quickly abſorbing, even in water, the oily and other ſoft parts of animals; and, when ſufficiently ſlacked, and thus impregnated with animal matter, without deſtroying the harder and firmer parts*.

The application of theſe circumſtances is eaſily imagined, and will be found to correſpond remarkably with all the appearances in the caſe before us. This depoſition, gradually and ſucceſſively concreting at the bottom of the water, may naturally be expected to aſſume a flag-like or laminar ſtructure; the grain too

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* To this, the cauſticity of lime, and its well-known application to dead bodies, with a view to their deſtruction, may be objected. On this account it may be looked upon by many as a *total deſtroyer* inſtead of a *partial preſerver* of animal ſubſtances. But beſides the diminution of this cauſticity by diffuſion in ſo great a body of water as our caſe ſuppoſes, we know that it muſt ſoon have acquired a ſufficiency of fixed air, or of the carbonic principle, from the abundance of animal juices furniſhed by the immenſe number of fiſh contained, to render it mild and prevent its preying on the firmer parts. This may eaſily be decided by actual experiment:—Mean time I beg to refer the Academy to the ſubjoined paper, which our learned and ingenious member, Dean Hamilton, who happened to be preſent at the firſt reading of this eſſay, has ſince done me the favour to communicate, and which contains facts and reaſoning ſo appoſite, that I believe they may be conſidered concluſive as to the objection now ſtated. That lime, though ſoaked in water, will ſtill greedily abſorb oils or other animal fluids, experience will determine, and its avidity for the carbonic principle will fully explain; add to this the weight, preſſure, and conſequent ſpeedy condenſation of the ſubſiding maſs, and I believe the effects ſtated may be regarded as highly probable. But if this be admitted, and ſhall be confirmed by ſuitable experiments, it will then deſerve to be conſidered, further, whether a greater or leſs degree of cauſticity of the incloſing calcareous matter, ſo far from an objection, may not prove to have been indiſpenſibly requiſite to the production of the effects, and, of courſe, whether the exiſtence of ſuch effects may not, in that caſe, be found a proof, and a ſtrong one, of that ſtate of cauſticity, and conſequently tend greatly to corroborate, if not to confirm, the whole of the account here given.

too of this new aggregate ſhould be wholly without luſtre, as well on account of its calcination, as of its formation by ſubſidence from, not in conſequence of ſolution in, a liquid menſtruum; in which laſt caſe alone cryſtals are known to be produced. This will further eaſily account for the formation of the calcareous ſpar found within the prominences occaſioned by the joints of the vertebræ, and the other groſſer bones; for, theſe being freſh and ſound at the firſt arrangement of the ſtone, of courſe excluded the ſubſiding matter; but in proceſs of time their hollows were filled, and by degrees, as it decayed, their ſubſtance replaced, by a ſucceſſive filtration of water holding calcareous matter in ſolution, which depoſited, plate after plate, its cryſtalline matter in theſe cavities. Of the abſorption already mentioned, the fetid ſmell emitted by every portion of this ſtone on being ſcraped, will ſurely be conſidered as affording a ſtrong preſumption, as it perfectly accords with, and would naturally follow from, the ſuppoſition, that the whole had imbibed, and been ſtrongly impregnated with, animal matter *.

In inveſtigating ſubjects of this kind, whoſe origin lies ſo very remote from any thing that either modern experience or hiſtoric record can produce, and particularly in a circumſtance like this,

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* This impregnation would alſo probably contribute to the concretion of the ſtone, as it is known to do in cements, floors, compoſitions, &c. to which cheeſe, milk, blood, and other animal ſubſtances, are often added with this view. A mixture of curd, or whites of eggs, with lime, has been long uſed as a ſtrong cement to repair broken China.

this, which is ſo very rare in the hitherto diſcovered natural knowledge of our globe, the utmoſt that can be expected is a reaſonable degree of probability, deduced, as the caſe may admit, from more or leſs appoſite analogy. If ſuch analogical reaſoning be fairly applied, it is but juſt to expect that the conſequences reſulting from it be admitted, until their falſity ſhall be proved, or a ſuperior degree of probability eſtabliſhed on different and more ſolid grounds. For this reaſon I ſhall, for the preſent, venture to aſſume as proved what I have juſt now ſuggeſted, and proceed to another link in the chain of cauſes that may be ſuppoſed to have been concerned in producing the effects under examination.

Taking it then for granted that the ſudden diffuſion of lime in the water in which theſe fiſh happened to be, and its conſequent depoſition, was the immediate cauſe of their encloſure, and the origin of this curious quarry, we are next led to enquire in what manner this lime may have been ſo burned, and ſuddenly projected into water, which but juſt before was proper for the ſupport of the animals inhabiting it. And here it is ſo obvious to have recourſe to fire as a proper agent for the calcination of lime-ſtone, and, from the apparently rapid and unexpected projection of the immenſe quantity which the thickneſs of the ſtratum indicates, to ſuppoſe this fire to have been volcanic; that although no ſuſpicion had ever been entertained of the exiſtence of ſuch a cauſe in the neighbouring country, or of its operation on the adjacent ſoil, this ſingle caſe would ſeem ſufficient of itſelf to have excited ſuch an idea.

THAT, where volcanic fire exiſts, it will burſt out ſuddenly, ſometimes in one place and ſometimes in another, as it happens to find more or leſs reſiſtance, is well known; it is alſo certain that the matter of its ejections muſt be various, as the ſubſtances chance to be, that lie within the ſphere of its activity, or fall within its vortex. That Veſuvius, for inſtance, (not to ſpeak of extinct and dubious volcanoes,) has at ſome periods thrown out an immenſe quantity of marble, and other calcareous ſtones, in various degrees of calcination, the beſt naturaliſts that have deſcribed that volcano aſſert, and I can fully confirm, both from actual obſervation, and from the ſpecimens which I collected there, and have had the honour to preſent to the Academy. Why then may we not ſuppoſe that other, and more ancient volcanoes may have acted upon calcareous matter as well as Veſuvius, and in a greater quantity? The circumſtances of the preſent caſe ſeem to demand ſuch a ſuppoſition; and if it is not inadmiſſible on ſtrong negative grounds, it invites our aſſent by giving a clear and eaſy explanation of the ſeveral effects in queſtion.

ALTHOUGH, for reaſons which I ſhall mention, it appears to me evident that the preſent ſituation of the fiſh quarries of Bolca cannot be that of their original formation, yet the great bulk of the maſſes that compoſe them, will not allow us to believe, that they could ever have been ſeated very remote from their preſent beds. But as it is abundantly clear, that the place where they were formed muſt have been covered with the ſea, it ſeems reaſonable to conclude that the ſea did then approach much nearer to Bolca than it does at preſent*, if it did not wholly cover that hill. But, this ſuppoſed, ſtill the immenſe number and variety of fiſh that are found incloſed in the very narrow compaſs of theſe quarries, ſo far exceeds any thing that in the ordinary courſe of nature is to be met with in any ſea of the world, that ſome uncommon cauſe muſt have occurred to aſſemble them thus, whether living or dead. Submarine volcanic commotions once admitted, (and that ſuch may exiſt the well-atteſted facts of new iſlands produced by them, in the Archipelago and elſewhere, ſufficiently prove,) may we not, in conformity with the other indications, account for this numerous aſſemblage of fiſh in one ſpot, by ſuppoſing that ſome new eruption of this kind might have driven them from their uſual haunts, to take refuge in ſome place, the moſt remote they could find, from the diſturbing cauſe; or, having deprived them of life, might have impelled or whirled their bodies into one pool. That the place where they were collected, whether living or dead, and in which they were buried in their calcareous incloſure, was not very remote from land, ſeems inferred by the mixture of river fiſh with thoſe of the ſea. This circumſtance, as it further proves the exiſtence of rivers at that period, evinces alſo that of hills raiſed much above the level of the ſea, from whence theſe rivers derived their ſources, and probably at no great diſtance from this ſpot*, which ſtands at the foot of the Alps of the country of Trent. Theſe fiſh then poſſibly may have been forced or drifted into ſome receſs adjoining their preſent ſituation, into which the newly erupted volcano ſuddenly poured an immenſe quantity of calcined calcareous matter, and thus gave riſe to the ſeveral conſequences that I have already deſcribed.

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* I have already obſerved that the neareſt ſea is now upwards of fifty miles from Bolca.

It now only remains to trace the inferences that ariſe from the conſideration of the general circumſtances and ſituation of the maſſes that form the fiſh-quarries of Monte Bolca: Theſe, I have obſerved, lie in detached bulks, ſet in different ſpots of the ſide of this hill; but the ſoil of Bolca is wholly argillaceous, its native ſtone reſembling our baſalte of the county of Antrim; and as far as I could ſee, or learn from the inhabitants, beſide the quarries in queſtion, it does not contain any calcareous matter whatſoever. Now theſe, though near each other, lie at ſomewhat different heights, and different inclinations of their laminæ to the horizon, as well as to the ſurface of the hill, and coincide with neither of theſe directions; from whence alone it ſeems evident that they could not have been formed in the places where they are now found; add to this their flag or laminar ſtructure, the leaves all parallel to each other, and perfectly ſtraight or flat; their compoſition, and the nature of their contents, all ſtrongly atteſting formation in a horizontal poſition:—and their want of continuation, the extremities being ſuddenly and ſharply cut off; ſo many circumſtances concurring, and tending all to the ſame concluſion, give it a degree of evidence that may almoſt be called demonſtration.

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* P. Pini, in his memoir above quoted, p. 242, ſays, that with the fiſh of Bolca are often found impreſſions of ſprigs and leaves of various trees. How far this may be well founded I cannot pretend to ſay, not having myſelf ſeen at Bolca, or in the collections at Verona, impreſſions of any other than *marine* vegetables. *He* does not ſay either, *that he had ſeen* ſuch impreſſions. Soc. Ital. di Verona, tom. 5.

But if it be admitted that the preſent ſituation of theſe maſſes muſt be regarded as foreign from their native place of formation, we have, in this, another object of inveſtigation, no leſs remarkable in itſelf than intereſting to the natural hiſtory of that country.

That theſe maſſes, in their original poſition, muſt have formed part of a continued, and horizontal ſtratum of ſome conſiderable extent, ſeems highly probable. If the account juſt now given of the origin of this ſtone be well founded, the thickneſs of the ſtratum evinces that the quantity of calcareous matter, ſuddenly poured into the ſuperincumbent water, muſt have been immenſe:—But this matter, immediately on its ſubſidence being pulverulent, or in the ſtate of a ſoft mud, muſt have lain to a great depth at the bottom of the water, and, from the levelling nature of that fluid, muſt have been ſpread out over a greater or leſs ſurface, as the ſhape of the ground, or bottom on which it lay, or the intervention of ſhores or other obſtacles may have permitted. At all events it is ſcarcely poſſible to imagine any circumſtances in which this ſtratum muſt not be conceived of a much greater extent than the very circumſcribed ſurface of the quarries of Bolca. Of ſuch a ſtratum then, theſe quarries are evidently to be conſidered as no more than portions or fragments, now completely disjoined from all connection with their native bed: We are next to enquire how theſe portions may have been ſo detached.

A NUMBER of circumſtances already mentioned leave not a doubt, that this muſt have happened after the conſolidation of the original ſtratum; for it is clear, that a disjunction of this kind could not have taken place, in any way, without ſuch a concuſſion and diſturbance of theſe maſſes, as, if their matter was in any reſpect ſoft or yielding, or in any other than a firmly compacted ſtate, muſt have greatly diſarranged their laminar ſtructure, as well as the forms of the fiſh contained. Their extremities too, inſtead of being ſharp and even, would have been left confuſed and ill-defined. This matter, therefore, muſt certainly have lain in its firſt bed and poſition, undiſturbed, ſo long at leaſt as was neceſſary to its perfect conſolidation. At ſome period ſubſequent to this, it would ſeem that the whole of the ſtratum was violently broken up, and immenſe fragments of it heaved from their natural ſituation, and diſperſed here and there, as in the inſtance before us. But when we calculate the prodigious forces required to produce the effects here deſcribed, we ſhall not find it eaſy to aſſign any other cauſe, fully adequate to them, but that which we have already had recourſe to, namely, ſubterraneous fire and exploſion; and this we muſt conceive to have operated, in the preſent caſe, with an eruptive force much exceeding whatever has been experienced in the known hiſtory of volcanoes*.

I HAVE choſen to repreſent the ſeparation of theſe maſſes, from the ſtratum of which they formed a part, as brought about, rather by their having been heaved up to their preſent ſituation from an inferior one, than by their having been left where they are, while the reſt of the ſtratum was ſunk; but I ſhall not trouble the Academy with the reaſons that led me to the one concluſion in preference to the other, as the principal point of enquiry is the nature or quality of the cauſe, not its preciſe mode of operation. Now, whatever may have been the manner in which the effects were produced, the immediate cauſe muſt, in any caſe, have been one of great violence; and there are many reaſons, beſides ſufficiency of force, to conclude it volcanic.

IT is remarkable that, except theſe quarries, nothing of the ſtratum to which they belonged is left, not a trace having yet been diſcovered, either at Bolca or in its neighbourhood, to indicate where ſuch a ſtratum had ever exiſted; all is covered with argillaceous materials, the ſuppoſed lavas and other ejections of ancient ſubmarine volcanoes: but this circumſtance, until it

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* If theſe effects are ſuppoſed to have been produced in air, the forces applied muſt have been immenſe; if under water, much leſs would have ſufficed.

it ſhall be better accounted for, admits of an eaſy explanation, by ſuppoſing that the ſame eruption which broke up the original calcareous bed, wherever it lay, and raiſed theſe fragments of it to their preſent ſituations, muſt, in ſo doing, not only have disfigured and wholly changed the appearance and ſhape of the former ſurface, but may naturally be conceived to have thrown out, at the ſame time, ſuch a quantity of argillaceous matter as was ſufficient completely to bury every other part and veſtige of it, except theſe maſſes which ſeem to have eſcaped, as it were, by accident.

THAT eruptions, and of the kind here ſuppoſed, did exiſt in the diſtrict in queſtion at ſome very early period, naturaliſts of great eminence have, long ſince, attempted to deduce from other conſiderations than thoſe contained in this paper; but as their reaſonings in proof of this are immediately connected with a very important mineralogical queſtion, which, though much diſcuſſed, remains ſtill in controverſy *, I ſhall not avail myſelf of their authority, reſpectable as ſome names are which I might otherwiſe adduce in ſupport of this opinion. It is not my intention, nor is it, I believe, at all neceſſary to my preſent ſubject, to introduce here any conſideration of the extenſive and difficult queſtion to which I allude; for whether the baſaltic columns, and other analogous covering of this and ſimilar countries, ſhall be attributed to the immediate agency of fire or of water, the conſequences which I have endeavoured to trace, from

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* It will eaſily be perceived that the queſtion alluded to is that *on the origin of baſaltes.*

from the examination of the fiſh-quarries of Bolca, may ſtill hold whatever degree of probability they may be thought entitled to; theſe conſequences, being deduced from local and partial circumſtances, and ſuch as are, perhaps, peculiar to that ſpot, and reſting principally on internal evidence, require to be judged ſpecially, and on their own merits, without being ſubjected to any determination that may be formed, as to the reality of other effects, imputed to the ſame general cauſe.

I HAVE now given the Academy the principal obſervations which aroſe in my mind from the inſpection of theſe curious quarries, and ſhall only add, that, as far as they have any weight, they go to infer the remote exiſtence of two diſtinct æras of great volcanic exploſion in this place, one of which at leaſt ſeems decidedly to have been ſubmarine; the firſt, when the fiſh were caught and incloſed in calcined calcareous matter; and the ſecond, after the complete concretion of this matter into ſtone, when its horizontal ſtratum was torn up and diſperſed.

BEFORE I conclude this paper I cannot omit taking ſome further notice of a circumſtance already mentioned, which ſeems to hold out a ſubject of inveſtigation the moſt ſtriking, and to many the moſt intereſting, that occurs, perhaps, in the whole range of natural hiſtory: I mean the great variety of fiſh collected in one ſpot, which, from the catalogues, appear to correſpond with ſpecies now only to be found in ſeas and climates the moſt remote from the Italian ſhores. It would be ſuperfluous to dwell on the analogy, which this remarkable circumſtance bears to the many diſcoveries that have been made, not only of ſhells, but of horns, teeth, bones, and other remains, and even of entire ſkeletons, of various land-animals, partly known and partly unknown, in countries where ſimilar living ſpecies have never been obſerved to exiſt, and often in climates now wholly unſuited to their conſtitutions. Theſe extraordinary facts have been long known, and have long excited the attention, and exerciſed the ingenuity, of naturaliſts of the moſt diſtinguiſhed talents: But, unfortunately, experience has ſhewn that the paths of ſpeculation to which they directly lead have too often conducted theſe great men into labyrinths, from which all the efforts of their genius have not been able to extricate them. Hence it would ſeem, that natural knowledge is not yet ſufficiently advanced, nor a ſufficient ſtock of well-atteſted phenomena yet formed, to enable us to proſecute ſuch extenſive and difficult enquiries with good effect. On this account, perhaps, thoſe who really wiſh to contribute to the ſubſtantial improvement of the ſcience, might employ their talents more beneficially, in the humble taſk of collecting facts, and inveſtigating partial and immediate cauſes, than in giving the reins to their imaginations, and ſoaring in purſuit of viſionary theories. Of more remote and general cauſes, poſterity, better informed by new facts and obſervations, in addition to thoſe which we now poſſeſs, may poſſibly form a better judgment than we can aſpire to, if ſuch a judgment really lies within the limits of human attainable knowledge. But, at all events, it ſhould not be forgotten, that ſpeculations of this kind are regarded by men of the ſoundeſt underſtandings, rather as amuſements of the mind, and relaxations from ſeverer ſtudies, than as purſuits of much intrinſic importance; and that, at beſt, they are to be conſidered as contributing but remotely to the more uſeful and ſerious objects of life: But when applied, as we know they have been too often, to excite and diffuſe doubts of the moſt eſſential truths, and ultimately to ſap the foundations of religion, and, with it, of both private and public virtue, order and happineſs, and indeed of the very exiſtence of civil ſociety, as too fatal modern experience has ſhewn, it is not eaſy to ſay whether we ſhall be moſt ſtruck with the vanity and preſumption, the folly, or the wickedneſs of the attempt, to raiſe ſo daring a ſuperſtructure on ſo ſlender a baſe *.

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* Since this paper was read, Mr. Raſpe has pointed out to me a paſſage in his Preface to Ferber's Letters, tranſlated and publiſhed by him in 1776, which had before eſcaped my notice: Speaking of ſubmarine volcanoes, he ſays " The petrified " fiſhes are monuments of their heat;" and adds, " ſome unnatural revolution in " their own element muſt have killed and involved them at once in the ſediments of " the troubled ocean; on this account, *many argillaceous ſlate rocks*, filled with petri- " fied fiſhes, are to be conſidered as ſubmarine or ſubaqueous volcanic productions; " nay, *many calcareous ſlates*, ſuch as thoſe at *Bolca*, *Pappenheim*, *Eichſtaed*, *Altheim* " and *Mont Libanon*, are, *for the ſame reaſon*, to be ranked amongſt them."

I tranſcribe this paſſage, as it ſeems to bear ſome reſemblance, though very generally expreſſed, to the account above given.

The deſcription of Monte Bolca, which we meet with in pages 49 and 50 of the ſame work, is erroneous in almoſt every particular. It is as follows: " Bolca is a " ſteep barren hill at twenty miles diſtance from Verona, *for the moſt part* of *ſtrati-* " *fied limeſtone*, but *now and then* interrupted by ancient *volcanic craters*. The lime- " ſtone contains *variegated flints*, *of a red, black, green and white colour*. In this hill " are found the famous impreſſions of plants and fiſhes."

Catalogo Siſtematico, dei piu' rari ictioliti del Monte Bolca che ſi conſervano nel gabinetto privato del Sig. Vincenzo Bozza, in Verona, nel quale vi ſono piu' di 500 eſemplari di peſci foſſili dello ſteſſo monte, una gran parte ancora da riconoſcerſi e denominarſi.

O R D I N E I.

Peſci dei Mari dell' Europa.

Ophidium barbatum. WILLOUGB. *Icth. Tab. G.* 7. *fig.* 6.
Squalus ſtellaris. LINN. *Syſt. nat. Edit.* 13. *pag.* 399.
Scomber colias. WILLOUGB. *L. C. Tab. M.* 1. *fig.* 1.
——— *ſcomber.* WILLOUGB. *l. c. Tab. M.* 3.
——— *pelamis.* SALVIAN. *de Aquatil. fig.* 98.
——— *thynnus.* ARTED. *Icth. Gen.* 31. *Synon.* 49.
Scorpæna porcus. BLOCH. *Icth. VI. Tab.* 181.
——— *ſcorpius.* WILLOUGB. *l. c. Tab.* 12. *X.*
——— *ſcrofa.* BLOCH. *l. c. Tab.* 182.
——— *Salviani.* WILLOUGB. *l. c. Tab. X.* 13.
Biennius ocellarius. SALVIAN. *l. c. fig. P.* 84.
Gadus carbonarius. BELLON. *de Aquat. Lib. I. pag.* 134.
——— *virens.* VILL. *l. c. Tab. L.* 1. *fig.* 3.
——— *merlucius.* BELLON. *l. c. Tab. L.* 1. *fig.* 123.
Pleuronectes limand. WILLOUGB. *l. c. Tab. F.* 4.
Sparus aurata. GRONOY. *Muſ.* 1. *n.* 90.
——— *chromis.* LINN. *l. c. pag.* 470.
——— *pagrus.* ARTED. *l. c. Gen.* 36. *Syn.* 64.

Trigla cuculus. WILLOUGB. *l. c. Tab.* 5. 2. *fig.* 2.
Eſox ſphyræna. LINN. *l. c. pag.* 515.
Muræna myrus. ARTED. *l. c. Gen.* 24. *Synon.* 40.
Lophius piſcatorius. SALVIAN. *l. c. fig.* 47.

Raja Poſtinaca
Muræna Helena
——— *Serpens*
——— *Cæca*
Gadus Mediterraneus
Blenius Lumpenus
Zeus Faber
Sparus Sargus
Labrus Turdus
Clupea Harengus.

MARQUIS GAZOLA.

ORDINE II.

Peſci dei Mari dell' Aſia.

Chætodon veſpertilio. BLOCH ICTH. *VI. Tab.* 199. *fig.* 2.
——— *bisfaſciatus.* SEBA. *Muſ.* 3. *Tab.* 26. *fig.* 23.
——— *pinnatus.* SEBA. *l. c. Tab.* 25. *fig.* 15.
——— *niger.* SEBA. *l. c. Tab.* 25. *fig.* 5. *a.*
——— *caneſcens.* SEBA. *l. c. Tab.* 25. *fig.* 7.
——— *lineatus.* SEBA. *l. c. Tab.* 25. *fig.* 1.
——— *fuſcus.* SEBA. *l. c. Tab.* 26. *fig.* 22.
——— *ſtriatus.* BLOCH. *li. c. Tab.* 205. *fig.* 1.
——— *macrolepidotus.* SEBA. *l. c. Tab.* 25. *fig.* 8.
Fiſtularia chinenſis. VALENT. *Ind.* 3. *fig.* 23.
Pegaſus natans. BLOCH. *Icth. IV. Tab.* 121. *fig.* 3. 4.
——— *volans.* LINN. *l. c. pag.* 418.

Polynemus paradiſeus. LINN. *l. c. pag*. 522.
Zeus ciliaris? BLOCH. *Icth. VI. Tab*. 191.
—— *triurus. Huic valde adſinis Zeus faber* LINN.
Tetraodon lagocephalus. SEBA. *l. c. Tab*. 23. *fig*. 5. 6.
Clupea Thriſſa. BROUSSON. *Icth. Dec. I. Tab*. 10.
Perca unicolor. SEBA. *l. c. Tab*. 27. *fig*. 10.
Eſox amboinenſis. RUYSCH. *Amboin. Tab*. 14. *fig*. 2.
Diodon reticulatus. SEBA. *l. c. Tab*. 23. *fig*. 3. 4.
Labrus ferrugineus. SEBA. *l. c. Tab*. 31. *fig*. 5. 6.
Muræna ſerpens. WILLOUGB. *l. c. Tab. G*. 10. *fig*. 1.
Callyonimus indicus. LINN. *l. c. pag*. 434.
Sparus argenteus. SEBA. *l. c. Tab*. 27. *fig*. 13.

Pegaſus Draconis.—MARQUIS GAZOLA.

ORDINE III.

Peſci dei Mari dell' Africa.

Sparus dentex. WILLOUGB. *lib. c. Tab. X*. 7. *fig*. 6.

Oſtracion Turritus.—MARQUIS GAZOLA.

ORDINE IV.

Peſci Marini dell' America meridionale.

Raja muricata. MARCGR. *Braſil. pag*. 175.
Scomber cordyla. WILLOUGB. *l. c. Tab*. 5. 18. *fig*. 1.
——— *coorza Piſonis*. WILL. *l. c. Tab. M*. 5. *fig*. 2.
Eſox braſilienſis. MARCGR. *l. c. pag*. 168.

Chætodon arcuatus. BLOCH. VI. *Tab.* 201. *fig.* 2.
——— *trioſtegus.* SEBA. *l. c. Tab.* 25. *fig.* 4.
——— *acarauna.* WILL. *l. c. Tab.* O. 5.
——— *fuſiformis. An. Ch. rhomboides?* BLOCH. *l. c. Tab.* 209.
Polynemus quinquarius. SEBA. *l. e. Tab.* 27. *fig.* 2.
——— *plebejus.* BROUSSON. *l. c. Tab.* 8.
Loricaria plecoſtomus. MARCGR. *l. c. pag.* 166.
Silurus bagre. SEBA. *l. c. Tab.* 29. *fig.* 2.
Gobius ſtrigatus. BROUSSON. *l. c. Tab.* 1.
Zeus vomer. BLOCH VI. *Tab.* 193. *fig.* 2.

Diodon Orbicularis
Mulus Gigas
Exocetus Evolans
Sparus Argenteus
Coryphena Hippurus
Chætodon Saxatilis
——— *faſciatus*
——— *ciliaris?*
——— *curacao*
——— *nigricans*
——— *cornutus*
——— *lanceolatus*
——— *orbis*
——— *arcuatus*
——— *aculeatus*
Silurus Faſciatus.
} MARQUIS GAZOLA.

ORDINE V.

Peſci marini dell' America ſettentrionale.

Baliſtes monoceros. CATESBY. *Carol.* 21. *Tab.* 19.
Chætodon chirurgus. BLOCH. *VI. Tab.* 208.
Eſox umbla minor. CATESB. *l. c. Tab.* 1. *fig.* 1.
Fiſtularia tabacaria. WILLOUGB. *l. c. Tab. P.* 6. *fig.* 4.
Exocetus evolans. CATESB. *l. c. Tab.* 8. *fig.* 1.
Gaſteroſteus carolinus. LINN. *l. c. pag.* 490.
Gadus tau. WILLOUGB. *l. c. Tab. N.* 12. *fig.* 3.

Gaſteroſteus Canadus
—— *Volitans*
Perca Venenoſa
—— *Punctata*
—— *Trifurca*
Scomber Faſciatus
Clops Saurus.

MARQUIS GAZOLA.

ORDINE VI.

Peſci di acqua dolce, eſotici.

Tetraodon ocellatus. Ex Indiis. SEBA. *l. c. Tab.* 23. *fig.* 7. 8.
Chætodon argus ex Indiis. BLOCH. *l. c. Tab.* 204. *fig.* 1.
Gobius ocellaris. Ex Ins. otheit. BROUSSON. *lib. c. Tab.* 2.
Clupea cyprinoides. Ez Braſilia. BROUSSON. *lib. c. Tab.* 9.
Zeus inſidiator. Ex Surate. BLOCH. *l. c. Tab.* 102. *fig.* 23.

Tetraodon Lagocephalus
Chætodon Glaucus
Sparus aurata ex America.

MARQUIS GAZOLA.

La grandezza di alcuni Peſci è rimarcabile, eſſendovene di quelli che giungono alli 40 pollici di lunghezza. Non ſi notano poi, nel preſente Catalogo, le ſingolarità di ciaſcheduna petrificazione, per ſervire alla brevità propria di un Indice.

Nel Gabinetto prefato, oltre ai Peſci foſſili, ſi conſervano le ſeguenti petrificazioni di altre Claſſi di corpi organizzati, cioè

I. Fitoliti di fuchi e felci europee ed eſotiche. Del Monte Bolca.

II. Zoofiti di Madrepore, Iſidi, Millepore ecc. dei Monti Veroneſi.

III. Elmintoliti di Conchiglie univalvi, e bivalvi di molti mari, con echiniti, ſtelle marine, e congierie delle medeſime. Delle Montagne predette.

IV. Entomoliti rari di granchi, inſetti apteri, e dipteri d'Europa, e di America. Del Monte Bolca.

V. Oſteoliti di Animali ruminanti, e di altri quadrupedi d'inſigne grandezza. Di Romagnano, e di altre parti del Veroneſe.